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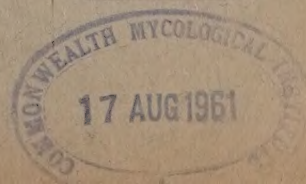
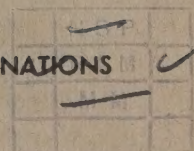
EXTERNAL RELATIONS
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**FIRST FAO TECHNICAL MEETING
ON COFFEE PRODUCTION
AND PROTECTION**

Held in Abidjan, Ivory Coast
21-29 October 1960



FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS



REPORT

of the

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21 to 29 October, 1960

FOOD AND AGRICULTURE ORGANISATION OF THE UNITED NATIONS
Rome, Italy

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LIST OF PARTICIPANTS

Delegates

Central African Republic

Head of delegation: J. P. GONTIER, Chef du Service de l'Agriculture,
B.P. 12, Bangui

M. P. DUBLIN, Chef de la Division de Génétique, Centre de Recherches
Agronomiques de Boukoko, M'Baiki

A. M. SACCAS, Directeur du Centre de Recherches Agronomiques de
Boukoko, Boukoko, par M'Baiki

Colombia

G. A. RODRIGUEZ, Jefe Servicio de Extensión, Federación Nacional
de Cafeteros, Feracafé Técnica, Bogotá

H. URIBE, Director, Centro Nacional de Investigaciones de Café,
Cenicafé, Chinchina, Caldas

Federation of Rhodesia and Nyasaland

Head of delegation: L. J. FOSTER, Department of Agriculture,
Bvumbwe Agricultural Station, P.O. Box 748, Limbe, Nyasaland

France

Head of delegation: R. COSTE, Directeur général de l'Institut
Français du Café et du Cacao, 20 rue Monsieur, Paris

Ghana

Head of delegation: H. E. THOMPSON, Acting Principal Agricultural
Officer, Ministry of Agriculture, Kpeve, Volta Region

J. E. M. BARTELS, Agricultural Economist, Economics Division,
Ministry of Food and Agriculture, Accra

G. K. A. BUAHIN, Agricultural Officer (Entomologist), Ministry of
Agriculture, c/o Scientific Services Division, P.O. Box 891,
Kumasi

K. K. TAYLOR, Principal Marketing Officer, Agricultural Development
Corporation, c/o P.O. Box 2309, Accra

India

Head of delegation: N. G. CHOKKANNA, Director of Research, Coffee
Board, Coffee Research Station, Balehonnur P.O., Chikmagalur,
Mysore State

Liberia

Head of delegation: M. HARRIS, Deputy Director of Agricultural Extension, c/o Department of State, Monrovia

C. BRIGHT, Assistant Director of Economic Research, c/o Department of State, Monrovia

The Netherlands

L. BRADER, Entomologist, University of Wageningen, B.P. 20, Abidjan

New Zealand

B. E. V. PARHAM, Director of Agriculture, P.O.B. 416, Apia, Western Samoa, South Pacific

Portugal

Head of delegation: A. Lopes Branquinho d'OLIVEIRA, Head of the Plant Pathology Department and of the Coffee Rust Research Centre, Estação Agronómica Nacional, Oeiras

M. ESTEVES, Agronome, Chef du Groupe de travaux de la M.E.A.U., Av. Almirantereis 69, 4^{Od}, Lisbonne

A. da FONSECA FERRAO, Chefe do Departamento do Sanidade Vegetal, Junta de Exportação do Café, B.P. 342, Luanda, Angola

J. A. T. VAZ, Director da Estação Regional do Amboim, Junta de Exportação do Café, Gabela, Angola

Republic of Cameroun

Head of delegation: B. NGILA, Chef de la Division des Statistiques Agricoles et de la Documentation au Ministère de la Production Rurale, B.P. 1073, Yaoundé

Republic of Congo (Leopoldville)

Head of delegation: L. AMANKOY, Directeur Chef de Service au Ministère de l'Agriculture, Léopoldville

J. D. J. C. CAPOT, Chef de la Division du Caféier et du Cacaoyer, Institut National pour l'Etude Agronomique du Congo (INEAC), Yangambi - 47 rue du Parc, La Louvière, Belgique

J. SNOECK, Chef du Groupe Café, INEAC, Mulungu, Kivu

Republic of Guinea

Head of delegation: B. CAMARA, Directeur général d'entreprise d'Etat, B.P. 613, Conakry

K. A. KOUROUMA, Ingénieur agricole, Directeur de la Station de recherches agronomiques du quinquina, Sérédou via Macenta

G. F. MATHOS, Député, Ministère de l'Economie Nationale, Conakry

Republic of Ivory Coast

Head of delegation: J. ANOMA, Ministre d'Etat, Président de la Caisse de Stabilisation des prix du café, Chambre d'Agriculture et d'Industrie, Abidjan

J. AKA, Député, Assemblée Nationale, Abidjan

A. H. ALLOT, Service de l'Agriculture, Dambokro

B. C. ANET, Député, Assemblée Nationale, Abidjan

M. BELIN, Chef de la Section expérimentale phytosanitaire de l'Institut Français du Café et du Cacao, B.P. 1827, Abidjan

A. CHOLLET, Inspecteur général du Ministère de l'Agriculture, Ministère de l'Agriculture, Abidjan

L. CORDIER, Généticien de l'I.F.C.C., B.P. 1827, Abidjan

R. DESCLERS, Président de la Chambre d'Agriculture et d'Industrie, B.P. 1291, Abidjan

P. DIOUF, Physiologiste de l'I.F.C.C., Bingerville

M. J. GOUJON, Phytopathologiste de l'ORSTOM, B.P. 20, Abidjan

H. JACQUEMIN, Maître de Recherches, ORSTOM, B.P. 20, Abidjan

M. L. HOUILLIER, Spécialiste des questions phytosanitaires de l'ORSTOM, B.P. 20, Abidjan

K. KONIAN, Président de la Caisse Nationale de Crédit Agricole, B.P. 1845, Abidjan

J. LANFRANCHI, Directeur de l'IFCC, B.P. 1827, Abidjan

M. LAUBHOUET, Député, Assemblée nationale, Abidjan

M. MEIFFREN, Phytopathologiste, I.F.C.C., B.P. 1827, Abidjan

M. MICHON, Directeur des sols, B.P. 1858, Abidjan

- H. MOULINIER, Pédologue, I.F.C.C., B.P. 1827, Abidjan
- M. PEYRELONGUE, Chef du Service de la Protection des Végétaux,
B.P. 1572, Abidjan
- N. OKA, Président du Centre National de la Coopération et de la
Mutualité Agricole, B.P. 782, Abidjan
- A. RENARD, Directeur du Service de l'Agriculture, B.P. 1572,
Abidjan
- G. SALLES, Chef du Service de la Production, Service de
l'Agriculture, Abidjan
- G. VERLIERE, Chef du Laboratoire de Chimie de l'I.F.C.C.,
B.P. 1827, Abidjan

Republic of Madagascar

Head of delegation: R. CREPIN, Directeur adjoint de l'Agriculture,
B.P. 255, Tananarive

United Kingdom

- R. E. G. BURNLEY, Acting Principal Agricultural Officer, Agricultural
Department, Buea, Southern Cameroons
- D. C. EDGALI, Coopt. Agric. Manager, B.C.U.F. Ltd., Buea,
Southern Cameroons
- J. B. D. ROBINSON, Director, Coffee Research Station, Lyamungu,
P.O. Box 3004, Moshi, Tanganyika (representing Kenya and
Tanganyika)
- D. O. WILLIAMS, Principal Agricultural Officer, Department of
Agriculture, Njala via Manu, Sierra Leone

Observers

Belgium

L. J. J. MICHEL, Ex-Directeur de l'Office du Café Robusta,
40 rue de Comines, Brussels

Canada

K. F. OSMOND, First Secretary (Commercial Office) of the High
Commission, c/o High Commission for Canada, P.O. Box 1639, Accra

Ghana

R. A. WHITE, Jr., Horticultural Adviser, USOM, c/o American Embassy,
Accra

India

C. B. RAO, Government Horticulturist, Andra Pradesh, Hyderabad

Liberia

A. L. ERICKSON, Horticulture Adviser, c/o American Embassy,
Monrovia

Republic of Cameroun

P. CAPLAIN, Administrateur du Syndicat des Planteurs, B.P. 3, Ponja

Republic of Gabon

G. H. HERLEDAN, Ingénieur des Services de l'Agriculture, B.P. 43,
Libreville

L. LAPEBY, Ingénieur des Services de l'Agriculture, Libreville

Ruanda Urundi

M. VAN DE STEENE, Directeur de l'Office du Café indigène du Ruanda
Urundi (OCIRU), B.P. 450, Usumbura

United States of America

J. F. GEHR, Agricultural Attache, American Embassy, Monrovia, Liberia

Commission Internationale pour la Lutte Biologique (CILB)

A. VILARDEBO, B.P. 1740, Abidjan

South Pacific Commission

B. E. V. PARHAM, Director of Agriculture, P.O. Box 416, Apia, Western Samoa, South Pacific

Centre d'Etude de l'Azote

J. BERGER, Expert, Soil Fertility, Case Postale 69 Stand, Geneva, Switzerland

G. KNOSP, Chef du Service Outre-Mer du S.P.I.E.A., 58 Av. Kléber, Paris 16ème, France

Institut International de la Potasse

J. CLAUZET, Case Postale Berne-Transit, Switzerland

Conference Secretariat

A. B. FAGUNDES, Tropical Crops Specialist, Plant Production and Protection Division, Rome

C. A. KRUG, Agricultural Officer (Tropical Crops), Regional Office (Eastern Zone), Rio de Janeiro, Brazil

A. L. MOLLE, UNSF Officer, Plant Production and Protection Division, Rome

A. VITON, Chief, Sugar and Beverages Branch, Commodities Division, Rome

INTRODUCTION

The First FAO Technical Meeting on Coffee Production and Protection was held in Abidjan, Ivory Coast, from 21 to 29 October 1960, at the kind invitation and with the valuable cooperation of the Government of the Republic of the Ivory Coast. The purpose of the meeting was to make a general survey of technical problems relating to coffee production and processing, as well as to evaluate the present position concerning research, extension and training in matters of coffee technology. Furthermore, the meeting aimed at the discussion of several FAO projects on coffee devoted to the solution of basic technical problems of broad general interest to all producing countries.

The meeting was attended by delegations and observers from Central African Republic, Colombia, Federation of Rhodesia and Nyasaland, France, Ghana, India, Liberia, Madagascar, Netherlands, New Zealand, Portugal, Republic of Cameroun, Republic of Congo (Leopoldville), Republic of Gabon, Republic of Guinea, Republic of Ivory Coast, Ruanda Urundi, United Kingdom, Belgium, Canada, U.S.A., Commission Internationale pour la Lutte Biologique, South Pacific Commission, Centre d'Etude de l'Azote and the Institut International de la Potasse.

The meeting was addressed at the opening session by H.E. the Minister of State of the Republic of the Ivory Coast, Monsieur Denise, who welcomed the delegates from abroad and stressed the importance of the Conference for the future of the world's coffee industry. He was followed by H.E. the Minister of Agriculture, Monsieur Monnet, who emphasized the interest of his Government in basic and applied research in relation to coffee.

The representative of the Director-General of FAO addressed the meeting, thanking the Government for the valuable moral and material support it had given the meeting, and drawing attention to the need for international cooperation in the solution of many important technical problems on coffee production.

H.E. the Minister of State was chosen as Honorary Chairman of the meeting and Monsieur Anoma, former Minister of Agriculture, was unanimously elected as Chairman. The following delegates were elected as Vice-Chairman: Messrs. Jacques Aka (Ivory Coast), René Coste (France), Hernán Uribe (Colombia) and N. G. Chokkanna (India).

All sessions were held in the Conference Hall of the Chamber of Agriculture and Industry.

FIRST PLENARY SESSION

After the adoption of the agenda, the following delegates were elected as Coordinators of the five Technical Sessions:

- (1) Genetic improvement - Mr Alvaro Rodríguez (Colombia)
- (2) Nutrition, water and shade requirements - Mr J. B. D. Robinson (United Kingdom - Tanganyika)
- (3) Coffee diseases - Mr Marcel Meiffren (Ivory Coast)
- (4) Insects and other pests - Mr Antonio Ferrao (Portugal)
- (5) Coffee processing - Mr L. Michel (Belgium)

An introductory statement giving a survey of technical production problems was presented by Mr C. A. Krug, Agricultural Officer, FAO Regional Office (Eastern Zone), Rio de Janeiro, which included a summary of the main background document "World Coffee Survey" distributed to participants. A discussion followed, in which delegates from France, India and the Ivory Coast participated. The need for increased research on Robusta coffee in Africa was stressed, and for the concentration of coffee production in the most suitable areas in the tropics. It was said that in India cultivation of Arabica coffee is being intensified even in areas where Robusta used to predominate, due to the much lower prices which are now being offered for the latter. It was pointed out that there was a great range of qualities, both within the Arabica and Robusta coffees sent to the various coffee markets of the world.

In conclusion, it was stated that sound international cooperation amongst coffee workers, both in the field of production and of economics, should lead to a favourable solution of the major problems affecting this commodity.

FIRST TECHNICAL SESSION : GENETIC IMPROVEMENT

Chairman: Mr René Coste

Coordinator: Mr Alvaro Rodríguez

Papers presented:

- (1) Alcides Carvalho (Brazil)
Coffee taxonomy, genetics and breeding. (Introductory paper).
- (2) L. Cordier (Ivory Coast)
The objectives of coffee selection in the Ivory Coast.
- (3) J. Snoeck and R. Petit (Republic of Congo)
Considerations on genealogical selection in Coffea arabica L.
- (4) Idem.
Comparative study of yields of various strains of Coffea arabica L.
- (5) Preliminary discussions on FAO Coffee Projects No. 1 and 4.

The introductory paper, prepared by Mr Alcides Carvalho, was presented by Mr C. A. Krug of FAO's staff, who stressed its main issues, related to the taxonomy, genetics and breeding of coffee.

During the discussions which followed, delegates of France, Portugal, and Central African Republic expressed their general approval of the contents of this document. Mr Coste (France) informed the delegates of the work on taxonomy of C. canephora, now being undertaken for the IFCC by Professor Portères at the Musée National d'Histoire Naturelle in Paris, and stressed the need for more work on the genetics and breeding of this species.

He gave full support to the recommendations concerning the establishment of world coffee collections and of regional variety and strains trials, and called attention to the species belonging to the group Mascarocoffea (Chevalier) of which some occur in Madagascar, due to the fact that they produce caffeine-free seeds; hybridization work would, however, be necessary in order to associate, if possible, this character with high-yielding capacity and better quality. The importance of exploration for wild coffees was stressed by Professor Oliveira, mainly having in mind the search for genes of disease resistance.

With regard to genetic characters in C. canephora, Mr Dublin informed the meeting that in the Central African Republic various mutants, similar to ones studied in C. arabica, have been found (fasciation, yellow pericarp, etc.). He also thought that coffee collections should only include types gathered in their native habitat.

Mr Cordier's paper, which contained general guide-lines of genetic improvement work of Robusta coffee in the Ivory Coast, was discussed by delegates from France, Portugal, Colombia and Central African Republic. Mr Coste emphasized the great variability encountered in the variety groups "Kouilou" and "Robusta" of C. canephora. Professor Oliveira thought that, in spite of the fact that Robusta types, in general, offer appreciable resistance to the coffee rust Hemileia vastatrix - some have been found to be immune to all strains - it would be worth while to intensify the studies on the degree of resistance offered by the large array of these types already collected in the Ivory Coast and elsewhere. Mr Cordier furnished further details on the procedures followed in the improvement work at Bingerville, which mainly consist of the following steps: 1) selection of ideal mother plants; 2) preliminary study of their clones; 3) regional clone trials; 4) hybridization among selected clones; 5) hybrid trials and 6) establishment of crossing plots. Details were also furnished on experimental designs, plot size, etc.

The two papers of the Republic of Congo containing information on genetic improvement work conducted at the Mulungu-Tschibinda station were presented by Mr Snoeck.

During the discussion which followed, in which delegates of Colombia and Portugal participated, addition information was presented by the authors on the subject of their papers. They also stated that, with regard to Robusta in Yangambi, the productivity of a clone does not in any way constitute a proof of the productivity of its illegitimate progeny. The possible genetic implications of this finding was also discussed.

Mr C. A. Krug then made an introductory statement with regard to the preparation of the FAO Projects on Coffee, mentioning the contents of a relevant document distributed to the delegates. Projects No. 1 - Exploration for native coffee; establishment of world collections; taxonomy, and No. 4 - Establishment of international breeding projects, pertinent to the present technical session, were submitted to the meeting for comments and discussion. The Chairman, in the capacity of Director of IFCC, gave full support to both projects, stressing the urgent need for recollecting and preserving wild coffee types, to avoid their gradual destruction - as has apparently already happened to certain populations of Coffea humilis in the Ivory Coast - due to the advance of agriculture. He also suggested that FAO could perhaps undertake to prepare a general catalogue of coffee species, varieties and cultivars, containing short, botanical descriptions and information on their native habitat and present occurrence in living collections. Professor Oliveira enthusiastically supported Project No. 1 and mentioned various examples of the successful collections which have already been made, particularly in Ethiopia, by Dr Pierre Sylvain while on an FAO Technical Mission in that country, and by United States pathologists and horticulturists. The importance of this project for future breeding work, mainly aiming at resistance to numerous diseases and insect pests was also stressed by him. The delegates were then informed by Mr Ferrao (Portugal) that, at a recent meeting of the African Phytosanitary Commission, it was suggested to prohibit, from now on, the introduction of any coffee-propagating material into Africa, a decision which would prevent the introduction of new diseases and pests. However, in view of the need of providing coffee breeders with ample germplasm for future breeding work, it was suggested that the first and urgent need is to explore for native coffee types and establish them in local collections, possibly in areas close to their native homes. As soon as adequate quarantine facilities are available, intercontinental exchange of propagating material could be expanded. The valuable assistance in the dissemination of coffee germplasm by the U.S. Department of Agriculture, which maintains at Miami, Florida, a large coffee collection, was stressed.

It was decided to have further discussions on these subjects at the Eighth and Ninth Technical Sessions of this Meeting.

SECOND TECHNICAL SESSION :

NUTRITION, WATER AND SHADE REQUIREMENTS

Chairman: Mr N. G. Chokkanna

Coordinator: Mr J. B. D. Robinson

Papers presented:

- (1) René Coste (France)
Nutrition. Ecology. (Introductory paper).
- (2) A. Loué (Ivory Coast)
New observations on the role of minor elements in the nutrition of Robusta coffee.
- (3) H. Moulinier (Ivory Coast)
Main characteristics of the coffee soils in the lower Ivory Coast.
- (4) J. B. Vieira da Silva (Portugal)
Contribution to the study of coffee and cacao root system development in some San Thomé soils.
- (5) J. A. Trancoso Vaz (Portugal)
Study of root system of coffee in relation to soil properties.
- (6) J. B. Vieira da Silva, J. Esteves Baptista and M. Antonietta Nunes (Portugal)
Plant transpiration as influenced by soil moisture content and use of cobalt chloride paper method to measure transpiration in coffee.
- (7) J. Boyer (Ivory Coast)
Drought resistance in two important varieties of Coffea canephora cultivated in the Ivory Coast.
- (8) J. A. Trancoso Vaz (Portugal)
Study of the shedding of fruits and flowers of C. canephora Pierre.
- (9) J. B. Vieira da Silva (Portugal)
Preliminary note on catalase activity in leaf tissues of Coffea arabica.
- (10) J. A. Trancoso Vaz (Portugal)
Schedule of experiments under way at the Regional Station of Amboim (Angola)
- (11) Idem.
Initial interpretation of three experiments under way at the Regional Station of Amboim (Angola)
- (12) C. M. Franco (Brazil)
Collar injury in young coffee plants caused by heat.

In his introductory paper Mr Coste made a general review of the problems of mineral nutrition of the coffee plant, as well as those of the influence exerted on coffee growth by soil and climatic factors. He laid particular emphasis on fertilizer experiments, on the use of leaf analysis for the diagnosis of mineral deficiencies

and on the research work carried out in connection with the water requirements of the coffee plant. He ended his review by referring to the need for further research work, especially in connection with physiological, climatological and pedological problems.

Mr Robinson (Tanganyika) emphasized the urgent necessity for the collation and exchange of research results on an international basis. This would avoid much of the duplication of research effort, besides forming a background for future research work. He remarked on the importance of standardizing soil and leaf analysis methods so that results obtained in different countries could be readily compared. He further suggested that the production of a colour atlas (coloured photographs) covering recognised mineral unbalance and deficiency symptoms, diseases, and insect damage, should be considered by the meeting on an international basis, through FAO.

The paper of Mr Loué reviewed the work recently carried out in Bingerville on the mineral requirements of the coffee plant, especially in connection with the deficiency of minor nutrients. In the discussion on this paper, Mr Chokkanna stated that research in his country had been directed recently towards the diagnosis and control of micronutrient deficiencies, notably zinc, and in one particular area, boron.

Mr Robinson commented on the importance of early diagnosis of suboptimal levels of mineral nutrition in the coffee tree (as opposed to diagnosing threshold deficiency conditions) by means of leaf analysis of older leaf samples on the coffee branch. Mr Loué used the third leaf pair, but work by Müller in Costa Rica and by the speaker in Kenya and Tanganyika, had shown that older leaves of a greater age on the branch, particularly those with maturing cherries in the leaf axils, were particularly sensitive indicators of the early stages of mineral shortages following withdrawal by the maturing crop.

The paper of Mr Moulinier described in detail the characteristics of Ivory Coast coffee soils, especially in relation to the nature of their parent material, and indicated the levels of nutrient deficiencies in each of them. In the discussion which followed, Mr Robinson mentioned the question of the physical condition of the soil profile, a subject equally as important as the chemical conditions. He also referred to the fact that sub-optimal uptake of plant nutrients in coffee regions where seasonal drought periods occur, can be and often is a direct consequence of a lack of available soil water to transport the nutrients into the tree. Thus, under those conditions, the element is not necessarily lacking in the soil (i.e. physiological deficiency) and no amount of fertilizer application will correct this condition unless irrigation is also available.

The paper of Mr Vieira da Silva described root measurements of coffee and cacao plants grown on San Thomé soils. On this subject, Mr Coste emphasized the many different factors which could influence the pattern of coffee root distribution in the soil, mentioning particularly water, oxygenation, drainage, mulching, shading, etc. and stated that the presentation of analytical results of nutrition experiments must be accompanied by a comprehensive description of external conditions so that other workers could compare the results obtained in the conditions in their own country.

The delegates of Colombia and United Kingdom (Kenya and Tanganyika) had an interesting discussion on the differences of coffee root systems developed under the conditions prevailing in East Africa, Colombia and San Thomé.

The paper of Mr Trancoso Vaz contained a detailed study of coffee root development in relation to characteristics of the soil profile.

An extremely interesting discussion followed on the results of the work carried out on this subject in relation to spacing and yields of coffee in the field, the effects of cultivation practices and the effective utilization of fertilizers. Summarising the most important points raised, which appeared to be common to the different areas, Mr Robinson referred to differences in root depth distribution which is dependent upon soil and climatic differences and to the essential need to spread fertilizers over as large a portion of the soil surface as possible. Results of experiments with deep cultivation varied considerably; some areas reported favourably and some unfavourably on this practice. Again, local physical and climatic conditions of the soil must surely control the response to these practices.

A summary of the paper by Mr Vieira da Silva on plant transpiration in relation to soil moisture content and the utilization of the cobalt chloride paper technique was presented and it was agreed that its results were in accordance with those found in coffee research carried out elsewhere. Concerning the paper by Mr Boyer on drought resistance of two important varieties of C. canephora, Mr Jacquemin described the reason for the very comprehensive studies being undertaken in the Ivory Coast on this aspect of coffee physiology, details of which are contained in the "Program of research work" outlined in a publication of the "Institut Français du Café et du Cacao". The main objective of this work is to establish criteria for selection work for drought resistance.

Mr Trancoso Vaz presented his paper containing a resumé of a preliminary study of flower and fruit shedding observed under field conditions in Angola.

The results of this paper showed that the intensity of shedding, affected by the availability of water, would also present differences in accordance with the location of the floral buds in the plant coppice.

A summary of the paper by Mr Vieira da Silva on catalase activity of coffee leaf tissues was presented by Mr Robinson who added that whilst it is admitted that catalase activity is highest in the most biologically active tissues, it does not offer a safe index of nutrient levels. He referred again to the importance of sampling older leaf pairs on bearing and non-bearing or lightly bearing branches, in order to obtain more accurate and sensitive information on the withdrawal of nutrients by the crop and sub-optimal nutrition conditions. In this way, a much closer practical control of mineral nutrition, at least of the major elements, seems to be possible.

Mr Trancoso Vaz presented a report on the research program being undertaken by the Regional Research Station of Amboim (Angola) together with some early results of three experiments, with particular reference to the apparent value of mulching. In the discussion, attention was called to the necessity for obtaining yield results for several years from trials of this nature before it was possible to draw firm conclusions.

Concerning the effects of mulching in Kenya, Mr Robinson gave yield results of trials which have run for 10 to 15 years, where increases in yield of from 30 per cent have been recorded in areas with bimodal rainfall and intervening drought periods. He also referred to the increases in bean size, notably the percentage of 'A' grade coffee, which also resulted. He then mentioned the question of the degree of soil cover in relation to rainfall (total intensity and distribution); aeration of the soil and fertilizer application (position) relative to the mulch. There was also the question of the time of application (before or after the rains) which should be varied with the total rainfall and its distribution during the rainy periods.

Mr Capot (Republic of Congo) referred to work in the Congo where water-logging had been observed following mulching. He also considered that an inert mulch material might be of value because of economic considerations when dealing with mulching operations over a large area, and because in some of the main coffee areas no mulching materials were available. Mr Robinson reported that a decrease in yield had been recorded in Kenya after the application of a complete mulch to coffee in an area receiving 50" of rainfall in a single season. He further reported that in Kenya the question of inert mulches had also been investigated. Paper did not stand up to it unless tarred, in which case it was similar to polythene sheet, in that rainfall penetration was adversely influenced. A comparison was also made between a stone mulch and one of straw of Pennisetum purpureum, with and without the addition of ammonium and nitrate nitrogen type fertilizers.

Finally the paper submitted by Mr Franco was presented. It dealt with the reproduction, under experimental conditions, of heat injury to young coffee stems, which had been previously observed in the field under very heavy sunlight intensities and with temperatures of the upper soil layer ranging from 40° to 60° C.

THIRD TECHNICAL SESSION :

"COFFEE DISEASES"

Chairman: Mr J. Anoma

Coordinator: Mr M. Meiffren

Papers presented:

- (1) Branquinho d'Oliveira and C. J. Rodríguez Jr. (Portugal)
A survey of the problem of coffee rusts.
- (2) Marcel Meiffren (Ivory Coast)
Contribution to the study of tracheomycosis in coffee plants in the Ivory Coast.
- (3) A. da Fonseca Ferrão (Portugal)
Phytosanitary Services of the "Junta de Exportação do Café".
- (4) Idem.
The "sudden death" of Coffea arabica in Angola.
- (5) F. L. Wellman (Puerto Rico)
Remarks about some pressing coffee diseases.
- (6) Revised FAO Projects Nos. 2 and 3.

Mr Meiffren introduced the subject of this session. He stated that, according to Mr Saccas, about 250 species of fungi have been found on coffee and that an increasing number of diseases caused by virus and bacteria are being detected. He presented a general survey on the severity of the main diseases occurring, particularly in Africa, among which he mentioned coffee rust, tracheomycosis, root rots, anthracnosis and cercospora. He stressed the need for expanded work on their causing agents and their control.

The main paper of the Session, presented by Professor Oliveira, contained recent results obtained at the Coffee Rust Research Centre at Oeiras, Portugal, on the biological specialization of coffee rusts and on screening for rust-resistant coffee seedlings of very diverse origins. He terminated his presentation by offering to all interested parties the tested coffee material available there, and by making an appeal for still broader cooperation among interested countries to enable this work to be expanded.

A very useful discussion followed the presentation of this paper, in which delegates of France, Central African Republic, India and Tanganyika participated, all of whom praised the great international value of the research conducted at Oeiras.

Mr Coste (France) stressed the need for more work on C. canephora since coffees of this species have shown, in certain regions, marked signs of susceptibility to rusts. He also proposed that the international scope of this laboratory be expanded under FAO's guidance, and he stated that the assistance of IFCC for such an undertaking could be envisaged.

Further discussion took place on the problems of: (a) effect of age, shade, altitude, temperature, humidity and fertilizer application on severity of rust infection; (b) modes of leaf infection; (c) chemical control and (d) breeding for resistance. The following are the highlights of this discussion: (a) old leaves are more resistant to rust infection than young ones; (b) in Tanganyika certain hybrids with the Geisha type from Ethiopia showed only slight infection after the fifth year; (c) direct sunlight usually prevented spore germination; (d) infection decreased with increasing altitude; (e) high temperatures and humidity favoured infection; (f) suitable fertilizer application increased speed of recovery of infected, defoliated plants; (g) chemical control should be aimed mainly at retaining leaves on trees; (h) a Rust Research Group, headed by Dr Nutman had recently been established in Kenya, where a well-coordinated and integrated research program was being carried out on coffee rust; special emphasis was laid upon breeding for resistance, some hybrids having shown remarkable hybrid vigour by producing, under rather unfavourable conditions, 1 ton per acre of clean coffee in their fourth year; four carefully-timed fungicide applications had been found most efficient in rust control, the emphasis no longer being laid on spraying the under-surface of leaves; (i) some sources of rust fungus, for instance, one from Ceylon, showed a more rapid effect than many other sources (5 days) when inoculated on leaves.

The paper of Mr Meiffren emphasized the severity of tracheomycosis, mainly in the Ivory Coast, and gave a general picture of the present status of knowledge concerning the degree of susceptibility of species and varieties, modes of infection, control measures, etc.

During the discussion which followed, in which delegates of the Republic of Congo, Ivory Coast, Portugal and Central African Republic participated, it was pointed out that: (a) in the Congo breeding work was being carried out for resistance to this disease, resistance apparently being dominant over susceptibility; (b) detailed comparative studies should be carried out on *Fusarium* strains, which caused this disease in the Congo and in the Ivory Coast, and (c) at the Bouakoko Experiment Station in the Central African Republic four different strains of the fungus had already been isolated, the opinion predominating that resistance might be conditioned by several genes.

Comments on the paper by Mr Ferrão, which dealt with phyto-sanitary measures to control coffee diseases in Angola, were made by delegates from the Ivory Coast and the Republic of Congo, the latter stating that the cost of control of the coffee berry borer in that country varied with the climatic conditions.

Much interest was shown in Mr Ferrão's paper on the "sudden death" disease of Robusta coffee in Angola, which had caused appreciable damage, destroying some 3 million coffee trees each year, with a loss of some 30 million escudos (1 US\$ = 28 escudos). The cause of this disease was still unknown, all indications being that no virus or specific nematodes or fungi were involved. Research was in progress to discover the agent (or agents) responsible for those great losses.

The delegate from Nyasaland informed the Meeting that a similar disease (die-back) on C. arabica, caused by Fusarium stilboides, was destroying coffee orchards in that country. The plants most affected were those weakened by high yields or unfavourable environmental conditions. It could be transmitted easily through pruning knives and also by Antestiopsis. Plants were attacked at any age, even in the seedling stage, and acid soils (pH 5.5 to 6) seemed to favour its dissemination. Field sprays helped to control this disease, but the growing of resistant varieties, such as "Caturra" may be the best way of avoiding losses.

A summary of Dr Frederik L. Wellman's paper was presented, and the author's recommendations and suggestions concerning future international cooperation on the solution of problems related to diseases such as rusts, antracnosis, virus diseases, root rots and fusariosis were stressed.

Mr C. A. Krug called the attention of the delegates to FAO Projects Nos. 2 and 3. He stressed the need for the expansion of the fine work of wide, international importance now being conducted at the Coffee Rust Research Laboratory in Oeiras, Portugal. Such expansion is needed to provide it with supplementary resources for more technical assistants, equipment, greenhouse space and travelling expenses and enable it to carry out a still more complete survey on the occurrence of rust strains, intensify its local research and establish cooperation through regional projects. The importance of this work was also stressed even for the Latin American coffee-producing countries where this disease did not exist.

With regard to the establishment of joint plant protection measures, the significance of FAO's Project No. 3 was pointed out.

At the end of the Session, Professor Oliveira showed several colour slides concerning his work on rusts in Oeiras, Portugal.

FOURTH TECHNICAL SESSION :

"INSECTS AND OTHER PESTS"

Chairman: Mr Hernán Uribe

Coordinator: Mr A. da Fonseca Ferrão

Papers presented:

- (1) E. M. Lavabre (Ivory Coast)
Inventory of the Ivory Coast coffee plantation insect fauna and of its evolution during the last ten years.
- (2) A. da Fonseca Ferrão (Portugal)
List of insects of Angola coffee areas identified for the Division of Entomology of the "Junta de Exportação do Café".
- (3) E. M. Lavabre (Ivory Coast)
Favourable and limiting factors of the attack by the scolytids of coffee branches: Xyleborus morstatti Haged.
- (4) A. da Fonseca Ferrão (Portugal)
Study of means of controlling Bixadus sierricola White
- (5) M. Meiffren and M. Bélin (Ivory Coast)
A trial of mixed insecticide and fungicide treatment against the coffee branch borer.
- (6) M. Houillier and M. Bélin (Ivory Coast)
Possibilities of microbiological control of leaf eating caterpillars in Africa.
- (7) A. da Fonseca Ferrão (Portugal)
Antestiopsis lineaticollis in Angola.

During the discussion of the paper of Mr Lavabre on coffee insect surveys in the Ivory Coast, Mr Ferrão stressed the importance of such surveys and suggested that similar undertakings should be carried out in all coffee-producing countries, and Mr Coste pointed out that comparative studies on the same insects, which caused great damage in different areas with diverse ecological conditions, would be most promising. A general exchange of information followed with regard to the incidence of Xyleborus morstatti, Stephanoderes hampei and Leucoptera coffeicola in India, the Ivory Coast and Central African Republic. In the latter, the incidence of the coffee berry borer had been reduced by suitable control measures, from 40 per cent to about 5 per cent.

Mr Ferrão's first paper dealt with a similar subject, and contained a list of insects so far encountered in coffee plantations in Angola.

Considerable discussion followed the presentation of Mr Lavabre's second paper on favourable and limiting factors affecting attack by the coffee branch borer, Xyleborus morstatti. Mr Houillier, of ORSTOM (Ivory Coast), explained that the larvae of this insect fed on specific fungi which invaded the tissues after the attack by the borer, and that the adults fed on young leaves and twigs. The Meeting was informed by Mr Buahin (Ghana) that this insect was the one most damaging to coffee in that country, that a considerable amount of work was being conducted on it there and that the highest incidence occurred during the months of July, August and September - a short dry period between two rainy seasons. Replying to a query from Mr Alvaro Rodríguez (Colombia), the delegates were informed that Xyleborus morigenus, which was common in certain coffee areas in Latin America, had only once been encountered in Africa, where it did not cause damage to this crop.

The next paper presented by Mr Ferrão dealt with the control of the stem borer, Bixadus sierricola. During the ensuing discussion, delegates of Ghana (Mr Buahin) and the Ivory Coast (Mr Houillier) presented further details on the effect of various insecticides and modes of application.

The efficiency of a combined insecticide and fungicide treatment (Dieldrin and Bordeaux Mixture) for the control of the branch borer, Xyleborus morstatti, was discussed in a paper presented by Mr Meiffren and Mr Bélin. According to a statement by Mr Buahin, a greater degree of control of this pest had been achieved in Ghana by adding oil to the fungicides in order to increase persistence, the best results having been obtained with Dieldrin and Perenox. Mr Chokkanna informed the Meeting that in India treatments against this insect had to be very frequent, due to its short life cycle; a systemic insecticide, "Systox", had also been tried out in his country.

Mr Houillier (Ivory Coast) then presented his paper (co-author: Mr Bélin) which dealt with preliminary experiments using a microbiological control method (culture of Bacillus thuringiensis) to destroy Epicampoptera caterpillars which attacked coffee in the Ivory Coast. During the following discussion, it was stated that the cultures of this micro-organism were already produced on a large scale in the U.S.A.

Professor Oliveira (Portugal) stressed the value of this research project and also called attention to the importance of insect control by viruses, which could be obtained for experimental purposes from Dr Kenneth Smith, Insect Virus Unit, Cambridge. According to Mr Gontier, experiments on microbiological insect control were also being conducted in the Central African Republic.

The last paper of this Session, presented by Mr Ferrão, dealt with another serious pest, Antestiopsis. The delegate from Tanganyika, Mr Robinson, informed the Meeting that this was one of the most damaging insects in that area, also causing seed malformation due to secondary attacks by fungi. Numerous insecticides had been tested, from pyrethrum to D.D.T. Malathion, a non-persistent insecticide, had recently given the most promising results and even more recently Parathion had been shown to be more effective. According to Mr Snoeck's information, mixtures of D.D.T. and Parathion had been found most efficient in the Republic of Congo. Large-scale treatments, even in all-African plantations, were carried out there. The delegate of Ruanda-Urundi, Mr van de Steene, stated that the fight against this pest cost that territory millions of francs, and that more trained local, African officers were needed there to expand control measures still further.

FIFTH TECHNICAL SESSION :

"COFFEE PROCESSING"

Chairmen: Mr J. Anoma and Mr R. Coste

Coordinator: Mr L. Michel

Papers presented:

- (1) R. Wilboux (Republic of Congo)
Introduction to the problems of coffee processing
(Introductory paper)
- (2) A. Baiao Esteves (Portugal)
Yield from roasting of green coffee, obtained by
calculation based on the ash content of the beans.
- (3) Idem.
Rough granulometric composition of Portuguese coffee.
- (4) Idem.
Some characteristics of green commercial coffee of
San Thomé and Prince Islands.
- (5) Idem.
Work under way on green beans of Portuguese coffee.
- (6) Idem.
Acidity in the green coffee beans.
- (7) Idem.
Controlling moisture content in green commercial coffee.
- (8) Idem.
Coffea var. Robusta de Ambriz infested with
Stephanodores hampei Ferr.
- (9) L. Michel (Belgium)
Processing of Robusta coffee for export.

Mr Michel, the Coordinator, made a brief introduction to the subject to be discussed and emphasized that efforts made to ensure good quality would be reflected in the level of prices.

The introductory paper by Mr Wilboux stressed that the value of coffee depended not only on intrinsic qualities but also on the way it was processed. Reference was made to influences which varieties or environmental factors, including cultural practices, had on intrinsic qualities.

The processes of fermentation were considered, with reference to the action of enzymes present in the pulp and of micro-organisms spontaneously developed in the tanks or inoculated on purpose.

The influence which fermentation had on quality was also considered, with a brief review of different opinions on the matter.

The different procedures for drying Robusta and Arabica coffee were reviewed in detail, and it was observed that Robusta coffees might stand higher temperatures in the drying process than the Arabicas.

Brief reference was made to dry processing, and to husking and sorting dry coffee, including the utilization of electronic sorters.

In the discussion which followed, Mr Coste expressed his concern over the problem of fermentation, pointing out particularly that well-conducted investigations, by Perrier in Brazil, tended to show that the use of the Raoeng did not exert any beneficial action on the organoleptic properties of coffee, a fact which was contradicted by Mr Michel's report. Normal fermentation might not improve coffee quality, but poor fermentation would certainly affect flavour.

Mr Michel explained that in Kivu fermentation might accentuate acidity.

Mr van de Steene alluded to the work on fermentation done in Ruanda Urundi, which showed that fermented coffees have better quality than those obtained by the Raoeng pulper.

Mr Robinson mentioned that in Kenya comparisons between different processes of fermentation and the Raoeng process showed that fermentation gave a superior cup quality.

Mr Chokkanna mentioned the unfavourable influence on quality exerted by fermenting over-ripe cherries, experienced in India. He then referred to experimental results which indicated that alkali-washed coffee was not inferior to fermented coffee.

Mr Robinson agreed that over-ripe or under-ripe cherries impaired quality but added that in East Africa alkali processing gave a slightly lower quality with certain coffees.

Mr Desclercs observed that serious consideration should also be given to other factors affecting quality besides processing. He added that dry processing also deserved detailed study, since there were many areas without conditions that would make wet processing practicable, and in conclusion, said that it was possible to obtain coffees of high quality by dry processing when this was properly carried out.

Mr Coste supported the opinion expressed by Mr Desclercs and made a brief review of the different factors affecting quality.

Mr Esteves presented various papers, reviewing initially the current work on green coffee from Angola. Local sampling was made for determination of physical properties, as well as chemical analysis. Reference was made to the influence of the alteration of coffee fat on quality, and to obscure aspects of the relation between the development of micro-organisms in storage and quality. He reported on the investigations carried out to determine the percentage of grains affected by the borer and the consequent quality deterioration, as well as on the work concerning the granulometric composition of Portuguese coffee.

He then proceeded to describe the comparative study of the methods used to determine moisture content of coffee, mainly those based on thermal treatment and electric capacitance.

Mr Robinson observed that air drying at 100° C. would result in loss in weight, due to thermal decomposition of some coffee constituents. He used temperatures of 70° C. with reduced pressure and obtained values which were used to calibrate electronic instruments.

Mr Esteves then presented his report on the characteristics of green Portuguese coffee, presenting data on the composition of Arabica and Liberica coffees submitted to different roasting intensities.

He then submitted another paper on the evolution of fats in green Robusta coffee upon ageing. The results indicated that for two years there had been a progressive increase in the acidity of the fats. Finally, he referred to his work on a method for the calculation of yield on roasting of Robusta coffee.

Mr Coste commented on the importance of these determinations in the case of Robusta coffee. He mentioned that considerable work had been done on these lines with Arabica coffees, but so far as Robusta coffee was concerned further investigations were needed. He referred to the program in progress, promoted by the IFCC, and finally

put forward the suggestion, which was supported by other delegates, that FAO should be asked to help coordinate the work being carried out in different countries with regard to the international standardization of types of coffee. He added that the need for a general study of this subject had already been stressed in the second volume of his book entitled "Les Caféiers et le Café dans le Monde".

Mr Michel presented his work on the methods of processing adopted in the Republic of Congo for Robusta coffee destined for export, and referred to the utilization of laboratory control data on the determination of marketing types, giving a detailed description of types of green Robusta coffee adopted in the Congo. He gave, on request, further information on sampling techniques and on the operation of the electronic sorter.

SIXTH TECHNICAL SESSION :

"ORGANISATION OF RESEARCH - EXPERIMENTAL DESIGNS"

Chairman: Mr René Coste

Papers presented:

- (1) N. G. Chokkanna (India)
The organisation of coffee research in India.
- (2) C. Fraga (Brazil)
Experimental designs

Mr Chokkanna presented his paper which contained a very comprehensive survey of the history of coffee research in India and described past and current activities of the Balehonnur Coffee Experimental Station. He also referred to the organisation of coffee research and to the way in which it was linked to extension activities. He ended his statement by mentioning the cooperation between his Station and research institutions in other countries, especially the Coffee Rust Research Centre at Oeiras (Portugal) which he thought deserved strong support by FAO. He also expressed the hope that the FAO projects on coffee research cooperation and on coffee literature would materialize.

Mr Coste remarked on the importance of a close association between coffee research and extension, which would ensure the utilization of experimental results by the producer.

Professor Oliveira expressed great interest in the publications of the Coffee Research Station of Balehonnur and his appreciation of the suggestion concerning the Rust Research Centre at Oeiras.

Mr Rodríguez informed the Meeting that the National Federation of Coffee Producers in Colombia maintains three services devoted respectively to research, extension and training. Close association between research and extension is ensured through periodic training of the extension experts at the Experiment Station and through the participation of the Head of the Extension Service in the Research Committee. He finally observed that great emphasis is given in Colombia to the need for concentrating coffee programs in the ecologically most suitable areas, and for developing other crops in the marginal coffee areas.

Mr Gontier referred to the present research programs being carried on in the Central African Republic and mentioned especially the breeding projects, the experimental work on fertilizer application and other cultural practices. He also explained the way in which the work of the research stations was extended to the farmers.

Mr Capot explained that up to now the means of disseminating information in the Congo had been the "Bulletin Agricole", which circulated the results of work undertaken by INEAC at Yangambi and other research stations. These stations acted also as training centres for young agronomists. The Department of Agriculture and agricultural services of private institutions also disseminate advice given by INEAC to European and African planters.

Mr Robinson stated that a demonstration day was the link between the producer and the research station. Liaison officers also made visits to different coffee areas, bringing back to the Station information on the problems being faced by coffee producers.

Mr Krug explained, on request, the methods used for liaison between experimental and extension work in Brazil. He referred to the organisation of research in the Instituto Agrônômico of Campinas in Sao Paulo, and in the Ministry of Agriculture. Extension was also carried out by the State and by the Ministry of Agriculture, which organised meetings in experiment stations for farmers. He mentioned also the extension work of the Brazilian Coffee Institute. In the State of Sao Paulo research was mainly carried out by the Institute of Campinas, many divisions of which were doing work on coffee problems. Coordination of work on coffee carried out by the different divisions was done by a Coffee Committee. Research on coffee pests and diseases was conducted by the Instituto Biológico. He then referred to the resolution passed by the First FAO Meeting on Cacao, emphasizing the need for an ecological approach to cacao research. In the case of coffee, it would also be desirable to have the existing problems approached on an ecological basis by investigators in different fields, in cooperation with each other. In conclusion, he referred to the long-term migration of coffee cultivation in the past and said that as no virgin lands remained, efforts were needed to avoid marginal areas and to concentrate production in those which were well suited to coffee cultivation.

Mr Coste described the organisation of the Research Centre of the Institut Français du Café et du Cacao at Bingerville, mentioning that the heads of research divisions control the "external" experiments and establish liaison between the Research Centre and the producers. These agricultural agents had to attend the periodic seminars held at the Centre.

Mr Ferrão (Portugal) explained the way in which the liaison was made in Angola, where two types of services were rendered, according to the resources of the producers.

Mr Robinson informed the meeting of the organisation of the Coffee Research Advisory Committee in Kenya, which enabled coffee producers to maintain contact with the research services. Further contact was offered by the Field Day periodically held at the Research Station. Mr Harris referred to the organisation of extension in different areas of Liberia.

The paper of Mr C. Fraga Jr., on "Experimental Designs", after referring to the need to improve the usefulness of coffee experiments and of facilitating the comparability of results of experiments carried out in different areas under different environmental conditions, outlined the main requisites for the design of experiments concerning coffee problems.

A lively discussion on the subject of this paper took place, in which delegates of the Republic of Congo, Ivory Coast, Central African Republic, Colombia, Nyasaland, Ruanda Urundi and India participated. Detailed information on this subject was presented by Mr Capot, of which the following points are of special interest: (a) soil heterogeneity and often also the presence of a large number of abandoned termite houses, sometimes covering up to 30 per cent of the soil surface, were a serious handicap for coffee experimental work in the Republic of Congo, limiting considerably the types of designs which could be used; (b) soil samples were collected and analyzed prior to the start of any experiment; (c) in progeny trials, small plots of two or even only one plant had been used formerly; now, long and narrow plots were preferred; (d) in Robusta breeding work, the following designs were now being used: (i) for clonal trials - single rows of 10 plants replicated twice; (ii) for trials with progenies obtained without control of pollination ("descendances illégitimes") - single rows of 10 plants replicated four times; (iii) for trials with bi-clonal material - single rows of 15 plants replicated six times; (e) the trials were harvested for at least 4 consecutive years; (f) the number of regional replications varied with the nature of the material to be tested and the general purpose of the trial; (g) interesting results had been obtained from an experiment conducted in Lula to determine the extent of border effects: the outermost row produced 35 per cent, the second row 25 per cent and the third row 12 per cent more than the average of the whole plot; (h) all experiments were established on completely deforested and cleared, but not de-stumped land.

At the Boukoko Experimental Station the size of the individual plots had been gradually reduced over the years; single tree plots were not advisable, however, due to root-rot damage, which causes many missing hills and makes it difficult to interpret the experimental results.

Mr Uribe called attention to the great difficulties encountered in conducting coffee experiments under shade; based on results obtained at Campinas, it had now been decided in Colombia to conduct progeny trials always without shade, as it was expected that the results would also apply to shaded conditions.

Mr Foster explained that, in Nyasaland, in order to collect preliminary information on the suitability for coffee growing of several areas, 50 small variety trials, following the Latin Square design and having one-tree plots, had been established in 1953. Other experiments dealt with shade and fertilizer treatments.

In Ruanda Urundi, where coffee orchards had, on average, only between 90 and 100 trees, special emphasis was laid on simple fertilizer experiments including only two treatments: with and without complete fertilizer. 1,500 plots had thus been established there on private orchards, located in 15 areas offering different ecological environments. Each plot had 20 trees, treatments being distributed at random. Increases in yield of 25 to 40 per cent had been secured in certain zones through fertilizer application.

According to Mr Chokkanna, experimental designs in India had often been changed subject to needs, the tendency, however, being to use simple designs for almost all experiments as, for instance, randomized blocks. Factorial designs were only employed at Experimental Station grounds. In newly established spacing trials, all plots had initially had the same number of trees per unit area, differential spacings being introduced at various stages by cutting out a varying number of trees or rows. A big shade experiment covered an area of 13.5 acres and included two shade treatments: (a) with a single species and (b) with a group of shade tree species.

Dr Fagundes pointed out that, with the exception of progeny trials which, according to data presented at the Meeting, only required at the maximum a period of 6 years' harvests, many other trials - as, for instance, shade mulch and fertilizer experiments - needed to be conducted during a longer period.

Mr Krug then introduced FAO Coffee Projects Nos. 5 and 6, dealing respectively with cooperative undertakings regarding some basic research problems and the dissemination of technical information.

SEVENTH TECHNICAL SESSION :

"SUGGESTED TECHNICAL PRODUCTION
PROCEDURES FOR TRADITIONAL COFFEE AREAS"

Chairman: Mr J. Anoma

Papers presented:

(1) Hernán Uribe (Colombia)

Technical coffee producing procedures. (Introductory paper).

Mr Uribe's paper contained a comprehensive analysis of research work carried out on coffee production practices and of the policies adopted in several countries aimed at improving productivity.

The subject was then thoroughly discussed, mainly by the delegates from France, Portugal, India, Republic of Congo, Tanganyika, Ivory Coast and Central African Republic.

Mr Coste stressed the need for more basic research work on the shade problem and also called attention to the fact that many publications on this subject lack information on various relevant aspects, such as climatic conditions prevailing in the areas where shade experiments had been conducted, Latin names of shade tree species used, etc. For the adequate interpretation of results, future shade trials should be carefully planned and would profit from basic research, mainly on plant physiology.

Mr Vaz (Portugal) called attention to the fact that Robusta coffee posed technical production problems which were different from those affecting Arabica, with which Mr Uribe's paper dealt. Ecological requirements were different in this species, as were systems of pruning; in addition, biennial bearing was less pronounced than in Arabica.

In India, according to Mr Chokkanna, special emphasis was laid on correct distance of planting, on pruning and on suitable shade management to raise yields per acre. Instances had been found with Robusta where increases in yields had been secured by increasing distances of planting from 6 x 6 ft. to 12 x 12 ft. The single-stem system of pruning was preferred. In areas with long, dry seasons, shade had to be regulated in order to reduce to a minimum competition for water uptake.

Mr Capot reported that in the Republic of Congo the multiple-stem pruning system gave better results (increases of 20 to 40 per cent in yields) than the single-stem method. When the latter was used, however, a higher percentage of mineral constituents was found in leaves and branches than in plants pruned according to the multiple-stem system. It was also found that high-yield clones had a lower content of mineral constituents in the vegetative parts of the tree than low-yielding ones.

According to Mr Robinson, single-stem pruning was preferred in Tanganyika for shaded Arabica coffee and the multiple-stem for sun-grown. Considerable changes had lately been observed in average yields per acre in Kenya: in the period 1947/48 to 1950/51, 18.8 cwt. of cherry coffee were produced per acre, a general increase to 38.4 cwt. per acre having been found for the period 1956/57 to 1959/60, thus placing Kenya second in the world with regard to average yields per unit area.

According to Mr Dublin, studies had been conducted in the Central African Republic to determine correlation between yields and nitrogen content in leaves. Some clones were found to have a higher N requirement than others.

EIGHTH TECHNICAL SESSION :

"SUGGESTIONS FOR THE ESTABLISHMENT OF A MECHANISM
TO PROMOTE INTERNATIONAL COOPERATION ON TECHNICAL COFFEE PROBLEMS"
and "GENERAL DISCUSSION ON FAO COFFEE PROJECTS"

Chairman: Mr N. G. Chokkanna

Coordinator: Mr C. A. Krug

In the introduction of the first of the above-mentioned subjects, stress was laid on the main issues contained in a relevant document distributed to delegates. It was suggested that the Meeting might favour the establishment of a Technical Working Party on Coffee Production and, within it, a small Technical Advisory Committee. It was also mentioned that an ad hoc Committee might be created during the Meeting to accomplish some preparatory work for future activities on coffee. In order to secure adequate financial support for the implementation of various FAO Projects on Coffee, it was suggested that the Director-General might be asked to approach Member Governments and institutions interested in coffee, in an attempt to set up a Special Coffee Fund at FAO Headquarters.

During the discussions which followed, delegates from France, British East Africa, Portugal, Colombia, Ivory Coast and the Central African Republic, gave their full support, in principle, to the suggestions made, stressing the fact, however, that none of them could assume any obligation with regard to possible financial contributions by their respective Governments to the proposed Coffee Fund.

Mr René Coste and Mr J. B. D. Robinson were asked to assist the Secretary of the Meeting in drafting the relevant recommendations for discussion at the next Session.

A general discussion was then started on the proposed FAO Coffee Projects.

Project No. 1: Exploration for native coffee. Establishment of world collections. Taxonomy.

The delegates of France and Tanganyika suggested the idea of organising a general catalogue of coffee species and varieties existing in collections all over the world, including information on their native habitat, as well as on their main botanical characters.

Mr Coste suggested that one of the proposed world collections should be established at Divo, where the IFCC was organising a new research centre for coffee and cacao. Madagascar, he proposed, would be an ideal place for the establishment of a collection of species belonging to the Section Mascarocoffea, with caffeine-free coffee types, some of them occurring wild on that island. He also suggested that newly collected coffee types should first be established in local conditions.

Professor Oliveira thought that perhaps it was too early to try to select the areas where the proposed world collections should be established, suggesting only that they should be placed in areas free from virus diseases of coffee.

Mr Gehr (U.S.A.) mentioned that the U.S. Department of Agriculture was developing a disease-free collection of coffee germ plasm at the U.S. Plant Introduction Station at Miami, Florida, at present comprising some 500 different introductions. This material, which includes many types resistant to Hemileia rust, is available to coffee research centres, some 30,000 seedlings already having been distributed to numerous countries. Mr Gehr also indicated that the United States offers its facilities for the quarantine of research stocks of coffee moving between countries. In offering these intermediate quarantine facilities to all countries, attention is drawn to the fact that the United States will not accept material for the exclusive benefit of any country or institution and reserves the right to distribute such material to any other country or institution as may be desirable.

Mr Gontier offered the facilities of the Boukoko Experiment Station of the Central African Republic for the establishment of an expanded coffee collection.

Mr Ferrão again called attention to the need for careful phytosanitary measures to avoid the introduction of new diseases and insect pests when moving coffee planting material from one area to another. Professor Oliveira fully agreed with Mr Ferrão, informing the Meeting of the precautions he took when material of the Coffee Rust Research Centre was sent out. Mr Coste, on the other hand, emphasized that phytosanitary measures should not become an obstacle to the introduction of valuable germplasm into any country, when it was needed for important breeding work.

Project No. 2: Expansion of research and testing for resistance to leaf-rust (Hemileia).

Various delegates, among them Mr Coste of France and Mr Robinson of Tanganyika, supported this project, the latter informing the Meeting that a regional project on rust disease was now being considered in his part of Africa.

Project No. 3: Establishment of joint plant protection measures.

Delegates from Portugal and Tanganyika participated in the discussions on this project. It was made clear that all coffee material existing at the Miami Experiment Station, Florida, had previously been cleared by the U.S. Department of Agriculture Quarantine Station at Glendale, Md., and should be called a disease-free coffee germ plasm collection. Mr Robinson also mentioned the valuable quarantine facilities existing at Muguga, Kenya. It was concluded that existing quarantine facilities might be considered as satisfactory for increased movement of coffee propagating material, but whenever possible seeds should be despatched in preference to vegetative material.

Project No. 4: Establishment of international regional breeding projects.

Professor Oliveira called the attention of the Meeting to the fact that this project applied particularly well to breeding for rust resistance and said that he looked forward to a still closer international cooperation in this field, the work of the Coffee Rust Research Centre being of broad, international scope.

The Director of IFCC gave his support, in principle, to this project, emphasizing, however, that the contribution of his Institute in this respect might be bound by certain restrictions which were laid down by its regulations.

Mr Capot mentioned a similar enterprise being conducted with oilpalm breeding in Africa and Asia and Mr Krug called attention to the International Rice Breeding Project started in the Far East some years ago.

The delegate of India gave full support to this project, indicating his willingness to give his cooperation.

NINTH TECHNICAL SESSION :

"FAO COFFEE PROJECTS"

Chairman: Mr J. Anoma

Coordinator: Dr A. B. Fagundes

The Session started with a general statement made by the Portuguese delegate, Professor Oliveira, who again stressed the great value of the coffee germ plasm collection maintained by the U.S. Department of Agriculture at Miami, Florida.

The last two FAO Coffee Projects were then discussed:

Project No. 5: Cooperative projects on some basic research problems.

Mr Coste stated that he gave his full approval to this project, stressing that the proposed undertakings should deal with certain fundamental aspects of coffee research. He thought that often it might be worth while to divide a given project into various parts, asking different stations to carry them out separately, but following a well coordinated plan. An ample exchange of information regarding coffee research programs being carried out at research stations would be of the utmost importance, in order to avoid too much duplication of effort. This suggestion was supported by other delegates, and Mr Houillier, of the Ivory Coast, suggested as an instance that internationally coordinated work on the coffee berry borer might be highly desirable.

Dr Fagundes mentioned the valuable work carried out by the Inter-American Institute for Agricultural Sciences in Turrialba, issuing periodic lists of research projects being carried out at agronomic experiment institutions in Latin America. It might perhaps be possible in future to issue similar mimeographed lists on a world-wide basis. Replying to a question, he explained that FAO had no intention of interfering with national programs on coffee research, but was interested in cooperative undertakings by national organisations, with regard to certain problems of broad interest to several or all coffee-producing countries.

Professor Oliveira thought that these cooperative projects would also be extremely useful in the field of coffee diseases. He suggested, for instance, that ways should be found to establish a Central Laboratory for the maintenance of viruses in living plant collections, mentioning that cultures of fungi were maintained at specialized laboratories which made them available to all interested parties. FAO might be able to assist in this matter.

When Mr Lanfranchi, of the Ivory Coast delegation, again stressed the need for a catalogue of research projects being carried out at coffee experiment stations, Mr Krug reminded delegates that, while preparing the "World Coffee Survey", special care had been taken to include in each chapter a detailed survey on coffee-research work pursued and programmed in each coffee-producing country.

Project No. 6: Coffee literature.

A full discussion followed the presentation of this project, and showed the great interest of all delegations in the improved dissemination of technical information on coffee. Delegates of India, France, Ghana, Portugal, Tanganyika, Ivory Coast and Liberia participated in this discussion.

With regard to the proposal to prepare a new book on coffee, written by a team of highly qualified specialists, Mr Robinson thought that FAO could instead invite specialists to issue periodically review articles on specific subjects.

The existing Coffee Abstracts, although very valuable, were not considered to be fully satisfactory, attention being called to the need for making them available in English, French and Spanish. Abstracts on specific fields of coffee research would also be most valuable. It was made clear that FAO did not intend to publish a new series of abstracts, but only to supplement existing ones and make them easily available to everyone in three different languages.

As an example, Mr Houillier mentioned that CRSTOM published a periodic bulletin of abstracts on subjects of medical and veterinary entomology which contributed to saving its investigators much time.

With regard to the coffee bibliography recently obtained through the merging of three existing ones, at the Coffee Brewing Institute in New York, the Inter-American Institute for Agricultural Sciences in Turrialba and the Agronomic Institute at Campinas, Mr Coste thought that this project should be considered as one of the most important, and that every effort should be made to make it available to as many coffee research workers as possible. It was also suggested that photostat copies or printed lists of selected subjects could be prepared periodically from this bibliography. Everything possible should be done to keep the bibliography up to date.

The Meeting was also informed that in Kenya a very comprehensive atlas, containing numerous colour plates on symptoms caused by mineral deficiencies as well as by insects and diseases, had been published, being obtainable at a reasonable price.

Mr Krug then presented three draft recommendations prepared by the Committee appointed in the previous Session dealing, respectively, with the establishment of a Technical Working Party on Coffee Production, the six FAO Coffee Projects and the establishment of an FAO Coffee Fund. They were unanimously approved by the Meeting. Their full text is included in the last chapter of this report.

Mr Gehr, of the U.S.A., then made a general statement expressing his personal opinion on the Meeting, and stressing that "carefully planned technical discussions had been used to logically develop an effective organism of international cooperation and collaboration on coffee".

At the end of the Session, the following delegates were elected as members of an ad hoc Technical Coffee Committee:

Mr J. B. D. Robinson	Tanganyika
Mr N. G. Chokkanna	India
Professor Branquinho d'Oliveira	Portugal
Mr Hernán Uribe	Colombia
Mr René Coste	France
Mr J. Lanfranchi	Ivory Coast
Mr J. D. J. C. Capot	Republic of Congo
Mr G. K. A. Buahin	Ghana
Mr Alcides Carvalho	Brazil

SECOND PLENARY SESSION

Chairman: Mr J. Anoma

Mr Albert Viton presented a general review of the current coffee situation, stressing the unbalance existing between production and consumption, and advancing the view that the efforts being made to restore the desired equilibrium in the coffee economy should be greatly intensified. He referred to the importance which research work on coffee problems had for the future of the coffee industry and explained that any expenditure on research and experimental programs would, in the long run, be repaid many times over.

Mr Viton's statement was reproduced in full and circulated to the Meeting.

THIRD PLENARY SESSION

Chairman: Mr J. Anoma

The Draft Report of the Meeting was read, and some amendments were proposed by various delegates. After the necessary corrections had been made, the complete document, including the three recommendations which had been discussed and approved at the Ninth Technical Session, was finally adopted.

CLOSING SESSION

The Closing Session was presided over by H.E. The Minister of State of the Republic of the Ivory Coast; H.E. the Minister of Agriculture, Mr Monnet, and other members of the Government were also present.

The Representative of the Director-General of FAO gave a brief summary of what had happened at the Meeting, in which he emphasised the importance of the discussions held and of the decisions taken; he also thanked the Government of the Ivory Coast for the invaluable support it had given to the Meeting, and all the institutions and organisations which had contributed so effectively to its success.

The Meeting was then addressed by the Delegates of Colombia, Ghana and Liberia, Messrs. Hernán Uribe, H.E. Thompson and M. Harris respectively; they expressed their appreciation of the opportunity which the Meeting had provided for extensive discussion of technical coffee problems and emphasised their indebtedness to the Government of the Ivory Coast and to FAO for their sponsorship.

H.E. the Minister of Agriculture, Mr Monnet, gave a resumé of the subjects which had been considered at the Meeting, and of the relationship which they bear to the world coffee economy.

In his closing address, the Chairman, H.E. the Minister of State, stressed again the importance of the Meeting; he thanked the participants for their technical contributions, on behalf of the Government, and expressed the desire that such undertakings should be repeated more frequently in the future.

EXCURSIONS

During and after the Meeting, the participants took part in four excursions which provided opportunities to observe the work carried out in the laboratories and experimental fields of institutions devoted to coffee and other tropical crops, and to visit coffee plantations in the most important coffee-producing centres of the Ivory Coast.

During the first of these excursions, the delegates visited the coffee farm of Mr J. Anoma, near Agboville.

During the second, the delegates, in the morning, visited the region of tertiary sands near Bofodoumé, where they saw two small plantations and a large one; thus they could make comparative observations of the varieties grown, the cultural practices followed, pests and diseases which occur, etc. In the afternoon, the delegates visited the Research Centre of the "Institut Français du Café et du Cacao" at Bingerville, where they received detailed explanations of the important work on coffee being carried out in the laboratories on soils, plant physiology, plant breeding, plant pathology and entomology.

The third excursion consisted of a visit to the laboratories and experiment station of the "Office de la Recherche Scientifique et Technique d'Outre Mer" (ORSTOM) during which the delegates were told about the interesting studies going on relating to coffee problems and to other aspects of tropical biology.

The fourth and last excursion consisted of a two-day trip for the delegates to the main coffee producing centres of Divo, Gagnoa, and Doumé, where they had an opportunity to visit various small and a few large plantations, in which the two important varieties of C. canephora were mainly cultivated, but some promising plots planted with other species of Coffea were also maintained. During this important excursion, which was sponsored by the "Institut Français du Café et du Cacao", the delegates had the benefit of the guidance and the technical information given by the President of the Institut, Mr René Coste, and by his associates of the Bingerville Research Centre.

ACKNOWLEDGMENTS

Tribute must be paid to the Government of the Republic of the Ivory Coast for the most generous moral and material support they gave to this Conference. It is also desired to acknowledge the kindness of the Chamber of Agriculture and Industry in putting its Conference Hall and other facilities at the disposal of the Meeting. Further thanks are due to the local staff who rendered such efficient service both before and during the Meeting.

RECOMMENDATIONS

The following recommendations concerning the future work of FAO in relation to technical coffee problems were approved by the Meeting.

I

The First FAO Technical Meeting on Coffee Production and Protection,

Considering the nature and scope of future technical work that could best be undertaken on an international basis under the auspices of FAO,

Noting the long-term and continuing efforts that will be required for the successful execution of this work,

Recognizing that some efficient organisation is needed to provide a framework for these activities on a continuing basis,

Requests the Director-General of FAO to take the appropriate steps leading to the establishment of an FAO Technical Working Party on Coffee Production, which would include a Technical Advisory Committee, to promote collaboration for the advance of coffee production technology.

II

The First FAO Technical Meeting on Coffee Production and Protection,

Convinced of the need for expanded efforts aiming at the improvement of the efficiency of coffee production,

Having surveyed the main technical problems of coffee production, protection and processing in numerous coffee-producing areas of the world,

Convinced of the advantages which would derive from suitable international cooperation to speed up the solution of some of these problems of broad, general interest to all producing countries, and

Having carefully analysed the six FAO Projects on coffee submitted to this Meeting for discussion,

Gives, in principle, its full support to the program of work and suggestions contained in the document in which these projects have been outlined by FAO, and

Requests that priorities and details concerning the implementation of these and other projects be worked out by the FAO Technical Working Party on Coffee Production and by its Technical Advisory Committee, the establishment of which is suggested in Recommendation No. 1 of this Meeting.

III

The First FAO Technical Meeting on Coffee Production and Protection,

Considering that the implementation of its Recommendation No. 2 requires suitable financial support,

Suggests that the Director-General of FAO approach Member Governments, as well as Institutions, Foundations and any other Organisation interested in coffee, for the purpose of securing the necessary funds for this undertaking.

